

1809

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Tetanus

Vol - An Inaugural Dissertation

On Tetanus

for the Degree of Doctor of Medicine

Submitted to the Examination of

The Rev: Mr Sewel S. T. P. Provost

The Trustees and Medical Professors of

The University of Pennsylvania.

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of Pennsylvania.

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Section 1.

The subject of this essay has engaged my attention, by the contrast, which it presents between the apparent magnitude of cause and effect. How trifling, oftentimes, are the remote causes of Tetanus? How formidable, how violent, the disease? The wild irregularity of vital action is, in no instance, more striking in its form, nor more awful in its progress, than in true tetanic affections. Nature in such cases suffers the most intensive agony.

I take up this most violent of diseases, in order to inform myself more minutely, respecting its nature and cure. If my inquiries, among the authors, who have treated of it, will enable me to meet cases hereafter with better resources than I should otherwise possess, I shall have reason to think the time, spent in consulting them, has been happily employed.

The word tetanus is greek, from *tēno*, I extend. I stretch out; and of course it literally signifies a tension, extension, or spasm. In medical language, tetanus being applied to the condition of living organs, denotes a spasm of the muscular system, by which the body and members are extended, and by which rigidity and tension is produced in the muscles themselves.

This tetanus or spasm, affects, almost exclusively, the muscles, which are subservient to voluntary motion. The voluntary muscles are more universally affected with tension, in this, than in any other form of spasmodic disease, and they are also more permanently affected, giving greater and more durable extension to the body. The greeks, therefore, may be considered to have applied the term tetanos very properly to a universal rigid spasm of the

Voluntary muscles.

These early cultivators of medicine distinguished tetanus into several kinds, or varieties. These distinctions, which will afterwards be considered, have been very generally adopted by the Byzantine physicians, by the Arabians, and by almost every modern who has written on this disease.

Section, II.

In giving the history of the form and symptoms of tetanus we may divide the course of the disease into three stages.

The first or forming stage is sometimes transient, but often of considerable duration. When it is the result of an alarm, fright or other violent emotion, it attacks is sudden and severe. When it proceeds from an organic lesion, dampness, cold or organic irritability, it forms slowly, and arises gradually to its most violent state. The first stage commences with the earliest symptoms and continues untill rigidity is extended over the whole body.

When the disease proceeds from escape of emotion, it begins to form immediately, and the general rigidity is rapidly established. See the case related by Dr Rogers, and published in Dr Barlow's Medical & Physical Journal.

When it proceeds from cold the first symptoms are felt in two or three days; and when it arises from organic lesions it is usually several days before any tetanic symptoms are perceived; and then often at in when the injured part is free from pain, or even when it has entirely healed.

Dr Mosely observes, that after a wound or surgical operation, in the West Indies, he never found any time untill the patient was entirely

Table II.

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exempted him from this disease.

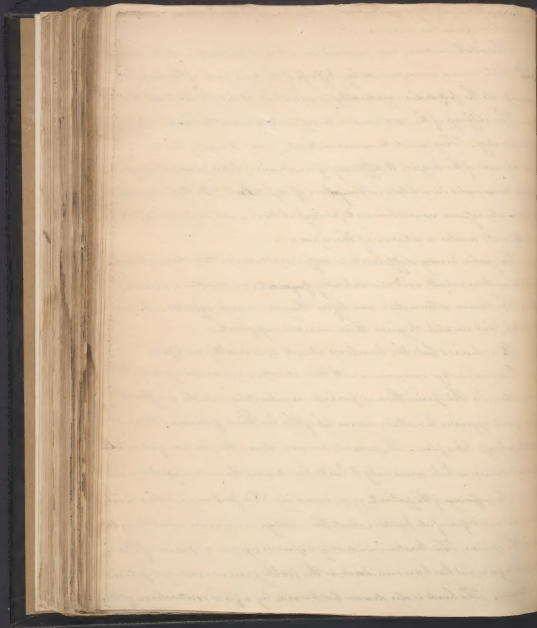
The attack in every case commences with a slight tension at the ~~passio~~
~~passio~~ ^{passio cordis} which is soon accompanied by stiffness of the back part of the neck. The
uneasiness at the ^{passio cordis}, gradually increasing, at length amounts to severe
pain. The stiffness of the neck renders it difficult to move the head. The jaws
also become stiff. They cannot be moved without pain. A sense of stricture is per-
ceived at the root of the tongue. A difficulty of swallowing takes place, which fre-
quently terminates in a total interruption of deglutition. In this situation
the patient refuses nourishment, as deglutition is not only painful
in itself, but excites a return of the spasm.

The pulse is very different in different cases in this stage of the disease.
Sometimes it is small and remarkably ~~fragile~~ ^{fragile}, and sometimes slow and
hard. The lower extremities, even before they are much affected with spasm,
are feeble, and unable to give their usual support.

It is observed that the bowels are almost universally constipated.

The second stage commences with the extension of pain and rigidity to the
extremities. In this period there is, perhaps no voluntary muscle unaffected.
Every part appears to sustain more or less of the burthen of disease. Obstinate
watchfulness takes place. The patient, however, retains the free use of his intel-
lect and senses, which serves only to make his situation the more miserable.

The sufferings of the patient go on increasing. He feels now and then a red-
den, and most painful traction about the cartilages ensiformis, which tends to-
wards the spine. This traction evidently depends upon a spasm of the
diaphragm, and has been considered as the pathognomonic symptom
of tetanus. The head is also drawn backwards by a fixed contraction of the



posterior muscles. The pain at the pæcordia returns every ten or fifteen minutes, and seems to bring along with it, a stronger retraction of the head, and more distressing pains of the neck, ascending to the occiput. This posterior spasm, and spasm extends instantly from the occiput and neck, along the spine, to the lower extremities. The whole body is extended, rigid and immovable, or convulsed and recurvated. The jaws are either fixed open, or as more commonly occurs, rigidly locked together. Any efforts of the attendants to open the jaws, when locked, or to shut the mouth when it is fixed open, hurried on the general spasm, and subjects the patient to consummate agony.

In the violence of a paroxysm the muscles of the whole body and extremities are thrown in the strongest degree contracted, and the body and extremities are thrown into new positions, which are governed by the superior force of the largest of them. The muscles of the jaws and neck, and the pectoral, and deltoid muscles, display their great power of action. The shoulders and breast are projected; the arms stretched out, or thrown across the body; and the hands either rigidly extended, or the fingers clenched.

The paroxysm runs its course in a few minutes, and though the patient still suffers from spasm and pain, he remains for a while comparatively relaxed and easy. After every paroxysm respiration is hurried, as if from excessive exercise. The face is, in some instances, pale, but for the most part, flushed during the ~~paroxysm~~ remission of spasms. The countenance is a prelude of the most melancholy distress.

The disease has now attained its utmost violence. The patient is constantly in torture; for the spasm, scarcely remitting for a minute, is more severe, and continues longer, in every succeeding paroxysm, as the power of different

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of the muscles is very different, and as they act in various measures irregularly, in the muscles. The ~~disease~~ jawismus, the tongue is forced into various and highly painful situations. The belly is constricted and hard. The abdominal muscles are not yielded to the descent of the diaphragm, which is itself in a state of painful traction, giving no assistance in respiration. Such is the state of suffering during the second stage of the disease.

The third stage, in the worst cases or those which do not assume a convalescent crisis, is gradually established by an aggravation of all the violent symptoms, connected with a sinking of the more important functions of life.

The pulse betrays the heart throbs with amazing frequency and irregularity, giving a peculiar capitating motion to the epigastric region. The heat of the body diminishes. Articulation becomes indistinct; the sound of the voice is changed to a grating and horrible tone, in mullering. The system watery and languid. Thirst ~~becomes~~ is insatiable, and the jaws are so fast locked, that drink or nourishment, even ~~though~~ if they could be swallowed, cannot be introduced.

The exhausted sufferer enjoys no repose. Sometimes a transient coma occurring in the intervals has been mistaken for sleep; but genuine sleep is never enjoyed. A delirium more frequently than coma comes, and is distinguished with the wild and anxious countenance of agony and despair.

There is frequently a suppression of urine, which gives with severity, as it is when the bladder is compressed. As the disease draws to close the tongue is sometimes violently thrust between the teeth. The prostrated, the eyes occasionally distend, are commonly fixed in immobility.



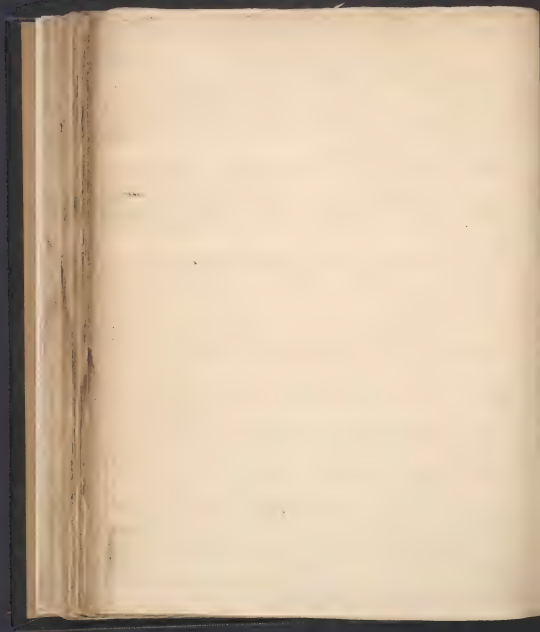
in their sockets. The arms are drawn upwards the chest, backwards, and the entire
embarrassment is made too, insupportable, dependent and violent pain.
In the midst of all these sufferings, sudden convulsion sometimes puts an end
to life. Sometimes there is a gradual diminution of the pain and
pains, with acid and universal sweats, before the mortal convulsion
comes to relieve the victim of tetanus.

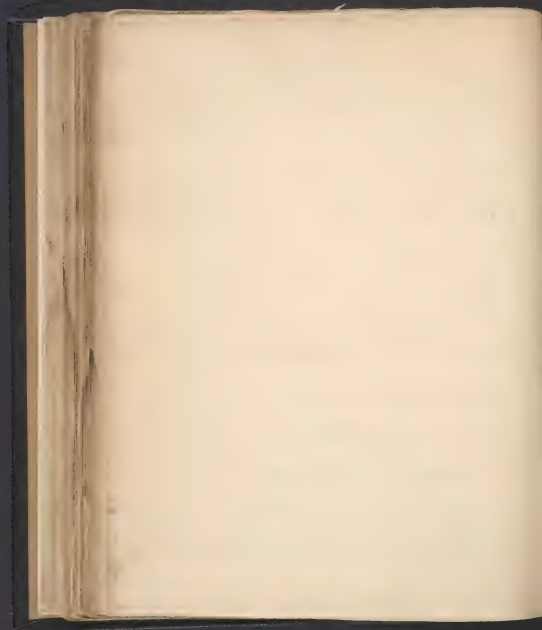
Tetanus was ably and minutely described by more of the oldest
writers on medicine. Hippocrates in particular has given much ~~very~~
evidence of this disease as evinces the utmost accuracy of patholo-
gical observation.

That as the ancient physicians had three varieties of tetanus
in their books, but it is doubted whether more than two very dis-
tinct ones exist in nature.

When the neck, body, and extremities, were extended, straight, ri-
gid, and inflexible, with the jaws locked, or the mouth fixed open - the
affection was strictly called tetanus.

When more violent action took place in the volitional mus-
cles, the posterior ones, being the most powerful, would then force bend
the body backwards, like a bow, and produce what they termed Opis-
thotonos. In this case the head is thrown back and remains immovable,
the anterior neck and thorax are projected forwards; a sudden increase
of pain attends with a piercing scream, and the patient
springs on his head and heels, so that the spine and hips form an arch
the weight remains to either side, or is thrown by the force of the arms
or contraction with violence on the floor.





acute & chronic affections, mentioned by the modern investigators. ...
 languages are calculated to, & are, in fact, better suited to, the more aptly they
 are liable to objection, than ...

When this disease arises from organic injury, though it does not
set in so early, after the accident, its course is rapidly calculating from the
attack, & seldom exceeds, and his observation, is confirmed by all who have
known, particularly acquainted with its history, that it often terminates
in a few days, and frequently takes place on the fourth or
fifth day. The much admired German writer just mentioned says, the
child survives the fourth day, the want of danger then nearly appears
to be no more correctly; for many die on the fifth, seventh, and even as
late as the 10th day; as is well known, in the Swedish cases described
by Hippocrate. The average time of duration was generally, in proportion
to the cause, a few days, say, on the fourth day.

Salmon says, however, that it universally exists, even in the same instance. He only says, he never saw a patient, who had a cure, after an operation, but that he prevents the disease in many. The way of Lippard was no better, nor was it getting from wounds. Still, however, there is the request, that the disease arising from such accident, is not imperially increased.

Section. III.

His summary, though even in the career of Johnson, is ample in
interesting extracts, view of this part of the subject is taken by the learned
summary, ^{the} in the first volume of his *critical* in his



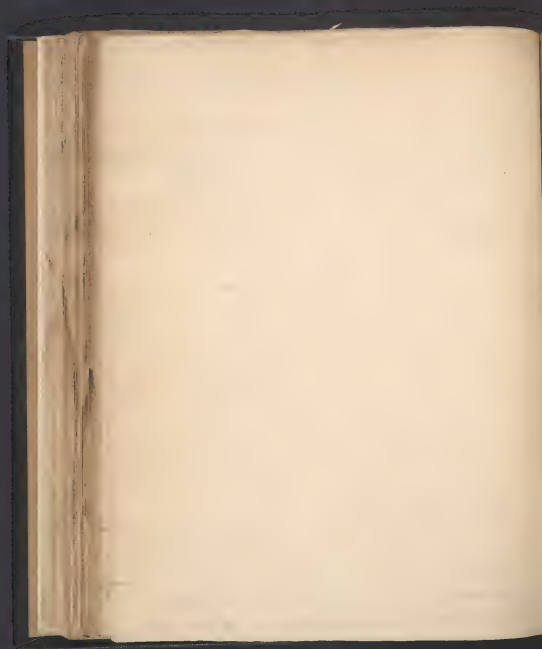
infections. He says "all the acute and protracted cases of tetanus are
in many putrid states of the system, & the muscular parts
of the body."

A party of physicians suppose that all spasms depend on a
disordered sensibility, and maintain that all diseases arising from the same
cause be cured by evacuations in those cases in which the system
is supported. There is little to be learned from such general dogmas, as
either the pathology or cure of tetanus, unless the case in the
immediate ^{attack} of the disease, which contains only two resolvable and one irremediable
disease, the disease is tropical diseases.

A late writer on tetanus Dr Hamdell, (London) appears to
think the protracted state of the intestine a small concern, intimately
connected with the formation of the spasm. Every one observes that a
disturbance in the course of the disease, every one knows that in
these matters the bowels induce great variety of symptoms, disaffec-
tion, is loose, is tight, is convulsed, is paralyzed. In various instances
but he communicates, and which present themselves with great uniformity,
"which exceedingly probable" he says "that the morbidness of the stom-
ach and intestines are intimately connected, previous to the attack, and
during the prevalence of tetanus."

The circumstance that tetanus is more frequent, in warm than
in cold climates, favours the sentiments of Dr Hamdell. The
inhabitants of warm climates are by far more subject to intestinal
spasm and other defects than those of cold or temperate latitudes.

Dr Boerhaave observes in some part of his work, that the heat of the



are remarkable for a habitual retention of the contents of the bowels. He says that it is customary, with the women to have only one or two evacuations weekly. He remarks also that much larger doses of cathartics are requisite, in order to open the bowels in the southern, than in the northern states of America. Boston Lectures.

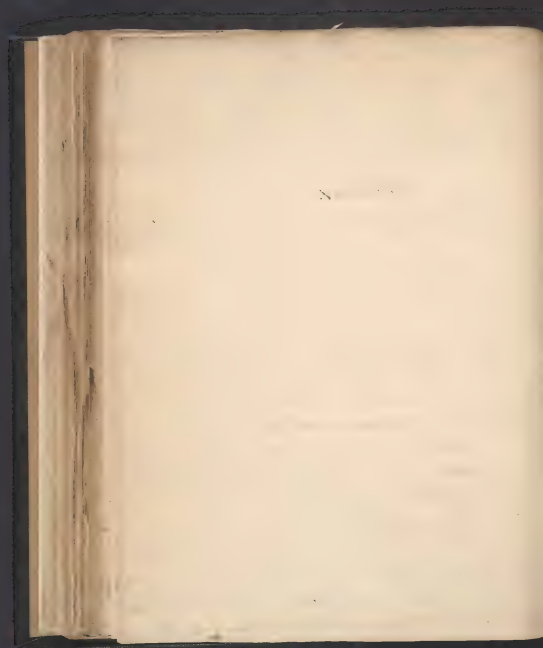
Section. IV.

The usage of Physicians in most of practice more precarious than in the treatment of tetanus. This, perhaps, owing to their making no allowance for the difference of causes inducing it. Dr Rush ascribes the want of uniform success to the use of the same remedies without any regard to the nature of the cause which produced it, and to an over-estimate upon some one remedy upon a belief of its specific efficacy.

Impressed with the truth of these sentiments, I feel encouraged to rehearse what has been done by a number of remedies, and in various views of practice, in the expectation of ascertaining more clearly to myself, the best mode of treatment, under different states.

Purification. This remedy has been serviceable both in the prevention and cure of this disease. Dr Rush found bleeding to be highly useful in tetanic affection, occurring in yellow fever patients.

And Dr Moens states that frequent bleeding with purging and a low diet, is the best preventive, in patients who are injured by the head. He mentions the case of one Moens, whom he supposes was saved by a large effusion of blood from his head in an operation for a fracture of the cranium. In this case the disease was not.



at other periods but it was slight and the patient recovered.

Purgatives. Dr. Rush maintains our attention to the uses of the latter. If it depends in any degree on obstruction in the passage of secretions, or on irritating morbidness lodged in the bowels, purgatives become necessary agents. Perhaps there is no case of biliousness in which they should not be judiciously employed, either by the mouth or by enema, in cases of organic lesion. They may prove prophylactic if administered regularly, from the time of the accident, as to preserve an open state of the bowels. I have just noticed that the use of them, as prophylactic, in connection with bleeding, is recommended by Dr. Monro. And I know of no writer who lays so much stress on the administration of purgatives as Dr. Hamilton.

Dr. Ferrié of Liverpool, says he gave great relief in two cases by the exhibition of castor oil glysters.

The night since which I have given, of the state of the system, and particularly that of the primary disease, is in favour of their use in the treatment of it. And in fact as they have been employed it appears they have been useful.

Dr. Monro is judicious in recommending aperients or glysters, as a medicine, a cool room, and a careful regimen, as preventives of the disease, after ~~any~~ ^{any} ~~operation~~ accidents or surgical operations.

Emetics. There have been rarely resorts to as remedies for tetanic affection. Dr. Rush says he "loosened the jaws of a woman" who was seized at the same time with a remitting fever by "an emetic."



From which we know of the injurious of enemies the murder
when it is not recognized to prove of some utility in the disease
under consideration. To prevent that evil, & facts, more corrected
might be attempted by such agents as will exert a powerful
influence in the system, might not attack the organization of the
jointness vice.

Incision. ^{Telamon} Excising from puncture wounds, & slight
injuries of tendons and parts, the knife has proved a speedy cure.
But incision has however the opposite to be in some cases a slight
cause of the extension of the disease by the force of granu-
lation. He thinks in such cases one of the principal measures for pre-
venting the spread, is to intercept all communication between the diseased
commune and the injured parts, by cutting across the tendon or making
an incision quite down to the bone. It must be remembered, that the advantage
from incision does not depend on cutting off the communication,
but on giving a new state of action ~~to the parts~~ perhaps an inflamed
or suppurative action, to the injured part. The common prac-
tice therefore is to enlarge the wound, or if it has nearly healed,
to cut down in to it, and at the same time make such application
as will tend speedily to assist reparation. This plan of
treatment, and every other local management, according to
computation, too frequently fail. They are therefore to be attended
to in conjunction with other active remedies, but must on
no account be relied on alone. Sometimes indeed incision
instantly removes the general disease, so that perhaps in the

* They might be proved useful by diverting action from the muscles to the
viscera, to blood vessels, and other parts.

are afterwards necessary to complete the cure, & employ a purgative to remove costiveness & is considered as a expedient.

Opium. This has been looked on as the anchor of hope by almost every modern physician, in the treatment of tetanus.

Opium is undoubtedly a proper remedy: but it is often a fallible remedy, & causes it should never be relied on: it ought to form a part of an extended plan of safety. A kind of Hospital appears to have however no other remedy. The women drink a full dose; but this full dose, is not equal one in balance, in one man he gave a scruple is less than twenty four grains. The stomach will sometimes bear, Dr. Worsley, observes, a dram of opium every two hours without producing sleep or diminishing the violence of any symptoms. The writer adds that he never found any benefit from a large quantity of opium: & some generally had not first produced some evidently good effect: and sometimes that there are many doubts, whether opium given alone has ever been of any utility.

Wine. Dr. Worsley and Dr. Currie have found wine highly useful when liberally employed. It has been used by other physicians with good effect since these gentlemen gave ~~in~~ their ^{experience} ~~opinion~~ concerning it to the public. Tetanus has been cured by ardent spirits likewise.

See Dr. Worsley's observations, &c.

Bark. Kinds of the most powerful kind, must prove at least beneficial as sedatives, and, unless they can be administered, as sedative agents, & other requires what this theory requires for bark must succeed with success.



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Essential oils. In use of musk is thought to be a considerable antispasmodic. I think however the happiest effects from an exhibition of weight drops every two hours in tetanus.

Balsams. Dr Kirkland has found the balsam of Peru of more efficacy in violent spasmodic diseases, arising from organic lesion. **Medical Surgery.** I think it wants prove useful as a preventer of convulsions; in conjunction with mild spassing medicines in true tetanus, but I would hardly expect a cure from it, when the disease is established. Dr Rogers used this most successful balsam, in a violent case of epilepsy with happy effects: a circumstance, in favour of its probable utility in tetanus. See Dr Bartons Journal.

Blistering. This is in its practice in tetanus. Colles and the balnearii, are ministers for the purpose. Blistering by cantharides is milder, but I doubt if it be a more efficacious method, than that of Colles in this disease.

Mercury. The great powers of this medicine over many diseases has led Physicians to give it a trial wherever uncommon difficulties are met with in practice. It is therefore often employed in dangerous affections without any well grounded expectation of its utility. In such cases it is thought to be the most promising of all agents for an experiment. Fortunately its various qualities renders it, not seldom, the just theme of applause. In tetanus, calomel, is rather less likely to be of more utility. But any medicinal employed to alleviate, will only remove the tollgate, and deliver by the hope of a desirable advantage, which he will never gain over the disease.



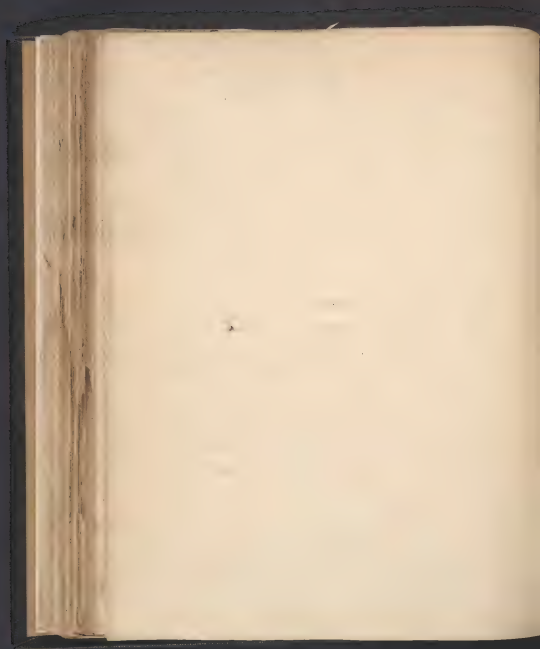
It may in some cases prove a useful auxiliary. Dr Rush saw a cure completed by a salivation. Dr Hosely is of opinion that Mercury used in tetanus has killed more people than it has cured.

Warm bath. The use of warm fomentations, the affusion of warm water, and immersion in the warm bath, are recommended by all. Modern practice confirms the propriety of the last measure in particular cases. The warm bath is indicated by a small and very frequent pulse, or by a slow feeble one; by a low temperature of the surface and extremities; and by occasional faintings with sensations of chilliness. It may perhaps be employed at any time when there is no violent action urgent.

Cold bath or affusion. This was the favourite resource of Hippocrates. He says a fever with a white, thick urine is a critical action of an agisthation. He therefore advises pouring plenty of cold water on the patient, to restore the natural heat which cures the disease. He directs this practice to be followed every in the summer. The attention of Physicians was called to this remedy by Dr Bright after it had been neglected. Dr Currie of Edinburgh, having many the cases of Dr Astruc and Boerhaave of this, gave the cold bath, and was happy in the result.

Dr Rush employed the cold affusion with success, in curing gunpowder injury near 1 one of the toes by, receiving a slight shock.

Dr Goodenough was uniformly successful with the cold bath in the East Indies.



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Tobacco. As far as this remedy has had a trial, it has been attended with no small share of success. It promises to become one of the most valuable agents in the treatment of tetanus.

Tobacco was first used in tetanus by Dr. Friedrich May, when he was a student of medicine. He was directed, by his preceptor, Dr. Warton, to give it a trial in a most violent case which arose from a wound. The injury in this case was produced by ^{a nail} just over the flexor tendon of the second toe. On the twelfth day the rigidity of the muscles commenced. The tobacco was not tried, until the disease was at its height, and after other means had entirely failed to mitigate the symptoms which its career. He administered the medicine by way of enema. And gave it in the extraordinary dose of two ounces in decoction. It is possible the whole of this strength of this large quantity of tobacco was not extracted by half a pint of water, but saturated, as it must have been, the whole of the decoction thus exhibited, could not fail to produce great effects in the muscular system.

The next trial of tobacco, communicated to the public was in a case successfully treated by Dr. Rogers. This case appeared in the Philadelphia Medical & Physical Journal, 1808. He gave the medicine in the form of enema, but in a much smaller dose than that of Dr. May. Dr. Rogers, without knowledge of Dr. May's success, prescribed one dram in decoction, in a very formidable case, which arose from violent agitation of mind. The second enema put a stop to the opisthotonus, spasm and convulsion, and the patient recovered her usual health by the assistance of purgative medicines. —

Dr Rogers informs me that he has put an immediate stop to the spasms in another similar case, by a decoction of two drams, in eight ounces of water, administered by enemas. I understand there have been other trials of tobacco in the disease of which we are treating; but I am ignorant however of the success attending them, as they have not been laid before the public.

The success of Dr Currie in epilepsy, by means of tobacco, indicates its power over the muscles. Its speedy operation as an emetic, in any way in which is presented to the *præna Via*, also shews that it must greatly affect the muscles; for all emetics in fact do so, & so affects them very considerably. It has been found to be in practice what theory would expect, almost powerful antispasmodic or relaxer of muscular contraction. I trust it will prove a better and more certain remedy in this terrible disease than any hitherto employed in its treatment.

admitted March 9, 1820

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